Remarks

Rejections Under 35 USC §103(a)

Claims 32-38, 40 and 58-62 have been rejected under 35 USC §103(a) as being unpatentable over Abe et al. (US Patent No. 6,402,013) in view of Glenn et al. (US Patent No. 5,482,736).

Claims 41-45 have been rejected under 35 USC §103(a) as being unpatentable over Abe et al. (US Patent No. 6,402,013) in view of Soderlund et al. (US Patent No. 5,611,,476) and Glenn et al. (US Patent No. 5,482,736).

Claims 32-43 and 45-62 have been rejected under 35 USC §103(a) as being unpatentable over Farnworth et al. (US Patent No. 6,180,504) in view of Abe et al. (US Patent No. 6,402,013).

Claim 44 has been rejected under 35 USC §103(a) over Farnworth et al. (US Patent No. 6,180,504) in view of Abe et al. (US Patent No. 6,402,013) as applied to claims 32-43 and 45-62 above, and further in view of Soderlund et al. (US Patent No. 5,611,476).

The claims have been amended to overcome the rejections under 35 USC §103(a).

Summary of the Invention

Claims 32-40, 46-52 and 53-57, are directed to a system 62 (Figure 5A) for fabricating external contacts (solder balls 44) on contact pads 32 of a semiconductor component 28. The system 62 includes a flux configured for deposition on the contact pads 32 as non flowing droplets 42 (Figure 2B). The flux includes a fluxing agent configured to clean the contact pads 32, a polymer resin configured to form polymer support members 46 (Figure 2D), and a curing agent configured to cure the polymer resin. In addition, the system 62 includes a mask 38 (Figure 2A) on the component 28 having openings 40 aligned with the

contact pads 32 and at least one conductive trace 34 (Figure 2A).

The system 62 also includes a flux dispensing mechanism 68 (Figure 5A) configured to deposit the droplets 42 (Figure 2B) in the openings 40 and on the contact pads 32. The system 62 also includes solder balls 44 (Figure 5A) and a placement mechanism 72 (Figure 5A) configured to place the solder balls 44 on the droplets 42 and the contact pads 32. In addition, the system 62 includes a furnace 74 (Figure 5A) configured to reflow the solder balls 44 onto the contact pads 32, and to cure the droplets 42 into polymer support members 46 (Figure 2D) bonded to the balls 44 and the mask 38, and masking the at least one conductive trace 34.

Claims 41-45 and 58-62 are directed to essentially the same system 62, but with the flux including solder particles configured to coalesce into a solder bump 48 (Figure 4C).

35 USC §103 Rejection of claims 32-38, 40 and 58-62 over Abe et al. in view of Glenn et al.

Independent claims 32 and 58 have been amended to include features which are not disclosed or suggested by the combination of Abe et al. and Glenn et al. In particular, claim 32 has been amended to state that the system includes "a mask on the component having a plurality openings aligned with the contact pads and some of the conductive traces". Claim 58 includes a similar recitation. The mask 38, openings 40, and conductive traces 34, are shown in Figure 2A.

Claim 32 has also been amended to recite that the system includes "a plurality of balls" (solder balls 44), and "polymer support members (46-Figure 2D) bonded to the balls, to the openings and to the mask". Antecedent basis for this recitation is contained on page 13, lines 3-7 of the specification. Claim 58 includes a similar recitation

but with solder bumps 48 (Figure 4C). As stated on page 13, lines 6-7 of the specification, the polymer support member 46 functions to "provide a rigidifying structure anchored to the substrate 30".

Claim 32 has also been amended to recite the function of the polymer support member of "masking at least one conductive trace." Claim 58 includes a similar recitation. Antecedent basis for this recitation is contained on page 13, lines 10-13 of the specification.

The soldering flux in Abe et al. includes a thermosetting resin. However, the resin is intended for use in soldering a chip component to a printed substrate, rather than for soldering individual external contacts to contact pads, as with the present system. As stated at column 2, lines 7-15 of Abe et al.: "when soldering small electronic components, in addition to soldering due to melting of solder on electrodes, a securing action is also exhibited at the same time by the thermal curing of the thermosetting resin in the flux around its periphery". As stated at column 4, lines 32-39 of Abe et al.: "When carrying out soldering of chip components using a solder paste obtained by mixing a flux and a solder powder, at the time of heating, the flux in the paste penetrates between the chip component and the printed substrate, and when soldering is completed, the thermosetting resin secures the chip component to the printed substrate".

In Abe et al. the solder balls are already present on the chip component, and the flux is applied to the electrodes on the printed substrate (column 7, lines 15-19). Although individual solder balls would be rigidified by the cured layer of flux, an additional structure, namely the printed substrate, is required to effect the rigidity. In the present system, the polymer support members are bonded to the mask and to openings in the mask, such that the additional printed substrate is not required to rigidify the balls. In addition, in Abe et al. the flux

could not bond to openings in a mask on the chip component because the solder balls would fill these openings.

Further, the flux in Abe et al. does not perform a masking function between the solder balls and associated conductive traces on the chip component because the solder balls are attached to the chip component prior to application of the polymer flux. Accordingly, shorting between the solder balls and the conductive traces could have occurred during bonding of the solder balls to the contact pads on the chip component.

Glenn et al. was cited as teaching a soldering method in which droplets of flux 22 (Figure 4) are applied to apertures 11 (Figure 4) in a solder mask 13 (Figure 4). However, this soldering method can't be used with Abe et al. because the solder balls in Abe et al. are already present on the chip component. In addition, in Glenn et al. the flux vaporizes, such that the reflowed solder balls 21a (Figure 4) attach directly to the pads 23 (Figure 4). Neither, Glenn et al. nor Abe et al. teaches or suggests that bonding of solder balls to chip pads can be improved by polymer flux droplets deposited between the solder balls and the chip pads. Rather, Glenn et al. teaches no flux between the balls and the chip pads, and Abe et al. teaches applying polymer flux between a chip component and a printed substrate.

35 USC §103 Rejection of claims 41-45 over Abe et al. in view of Soderlund et al. and Glenn et al.

Independent claim 41 has been amended to include the above identified recitations of amended independent claims 32 and 58. Accordingly, the above arguments with respect to Abe et al. and Glenn et al. not disclosing or suggesting all of the features of the present system are essentially restated. Further, Soderlund was cited as teaching "a solder reflow furnace with a conveyor for moving component between furnace zones". However, the cited combination

still does not disclose a system in which a polymer flux is applied to contact pads on a component, and a furnace is used to form polymer support members bonded to solder balls and openings in a mask.

35 USC §103 Rejection of claims 32-43 and 45-62 over Farnworth et al. and Abe et al.

Farnworth et al. is directed to a method for fabricating a semiconductor component in which polymer support members 54 (Figure 5A) are formed around contact balls 10G (Figure 5A). However, the contact balls 10G are bonded to the bonding pads 12G on the component prior to the support members 54 being formed (column 4, lines 1-17). Similarly, in Abe et al. the solder balls are already present on the chip component, and the flux is applied to the electrodes on the printed substrate (column 7, lines 15-19). Accordingly the cited combination does not disclose a system in which droplets of polymer flux are applied to contact pads on a component, and then cured to form polymer support members, which perform a rigidifying and masking function on the component standing alone.

35 USC §103 Rejection of claim 44 over Farnworth et al. and Abe et al. and Soderlund et al.

With respect to the 35USC §103 rejection of claim 44, the above arguments are essentially restated.

Conclusion

In view of the arguments and amendments favorable consideration and allowance of amended claims 32-52 and 53-62 is respectfully requested. Should any issues arise that will advance this case to allowance, the Examiner is asked to contact the undersigned by telephone.

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